SCAG's Port and Modal Elasticity Study: Stakeholders' Briefing

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Project team

- **Rob Leachman, Leachman & Associates LLC**
  - Prof of Industrial Engineering/ University of California at Berkeley
  - Thirty years experience in rail planning studies
- **Tom Brown, Strategic Directions LLC**
  - Intermodal Transportation/Logistics Consultant
  - Twenty years experience in intermodal operations and marketing
- **Ted Prince, T. Prince & Associates LLC**
  - Supplier of intermodal operating software
  - Twenty-five years of experience in domestic train and intermodal operations and marketing
- **George Fetty, G. Fetty & Associates, Inc.**
  - Specialist in Southern California rail and intermodal issues
  - Thirty years experience in railroad operations management

Aim of the study

- Container fees on imports are an increasingly prominent topic in legislatures
  - Response to traffic generation
  - Means to finance new infrastructure for access to ports
- This study aims to determine the elasticity of San Pedro Bay Ports' volume to potential container fees

Structure of Study

- Industry assessment
  - Methodology
    - Stakeholder interviews by entire team
  - Components
    - Operational framework
    - Port competition
    - Traffic composition
    - Vessel deployment
    - Economics of transloading
- Elasticity model
  - Methodology
    - Analytical model done by Dr. Leachman
  - Components
    - Transportation cost
    - Inventory cost
    - Importer segmentation
    - Congestion impact
    - Limitations
    - Interpretation

Stakeholder input

- Significant industry outreach
  - Stakeholder interviews to ascertain industry practices and general direction
    - Trans-pacific steamship lines
    - Railroads
    - Major retailers
    - Port authorities and terminal operators
    - NVOCCs and 3PLs
    - Truckers
    - Industry suppliers
  - Four SCAG stakeholder meetings

Data sources

- Quantitative data came from several sources
  - PIERS and WTA data received from POLB
    - 2001-2003 PIERS data for West Coast ports
    - 2001-2003 WTA data for entire USA
  - PIERS data received from MARAD
    - 2003 Asia trade totals for all US ports
  - Obtaining accurate and granular data for this study was a challenge

Part One

Industry Assessment

Competitive position of SPB ports

- Share of vessel strings
- Container traffic shares
- Factors driving use of
  - SPB v. Alternative West Coast ports
  - West Coast v. East Coast ports for Asia-US traffic
- Transloading as a driver of port choice

2Q03 Asia – U.S. vessel service

- 70 total weekly vessel strings
- 21% make first stop on U.S. East Coast
- 52% make first stop at San Pedro Bay
- 15% make last stop at San Pedro Bay

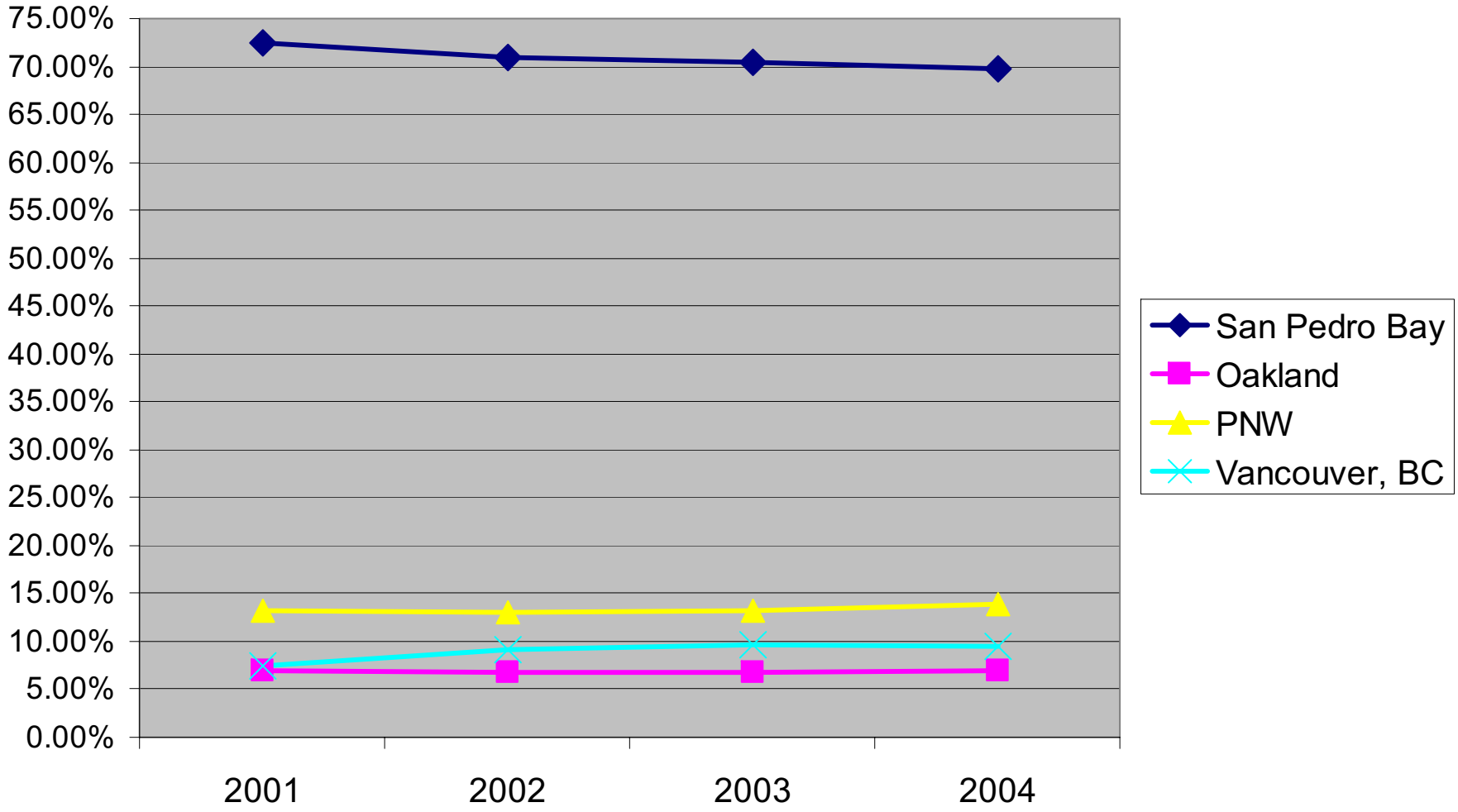
2003 Shares of Asia – U.S. containerized trade

Port Region	Imports	Exports
LA-Long Beach	60.5%	39.7%
Other US West Coast	16.1%	30.8%
US Gulf + East Coasts	23.4%	29.5%

Note: Shares measured on a TEU basis

Source: PIERS, courtesy of MARAD

Shares of Inbound Loaded Containers at West Coast Ports



Alternative West Coast ports

- Landside costs and services are roughly comparable from all West Coast ports to the intermodal regions (Upper MW, Neutral East, South)
  - Vancouver has some exchange rate advantage,
  - Port operating costs are lowest in U.S PNW ports,
  - Landside costs are lower from the SPB ports.
- The steamship lines prefer to call at the largest local market first and off-load inland cargoes there.

Mexico

- No significant volume of Asian goods as yet to USA via Manzanillo or Lazaro Cardenas
  - Compared to SPB Ports, closer to Houston, somewhat farther to KC and Chicago
  - Reliable rail service not offered yet
- New ports south of Ensenada proposed

West Coast vs. all-water

- All-water share of Asian imports increased from 18.6% in 2001 to 21.0% in 2002 to 23.4% in 2003 (on a TEU basis)
  - Discount retailers opened large distribution centers near East and Gulf Coast ports
- Economic trade-off: inventory cost vs. shipping cost
  - Inventory cost favors West Coast ports
  - Shipping cost favors all-water

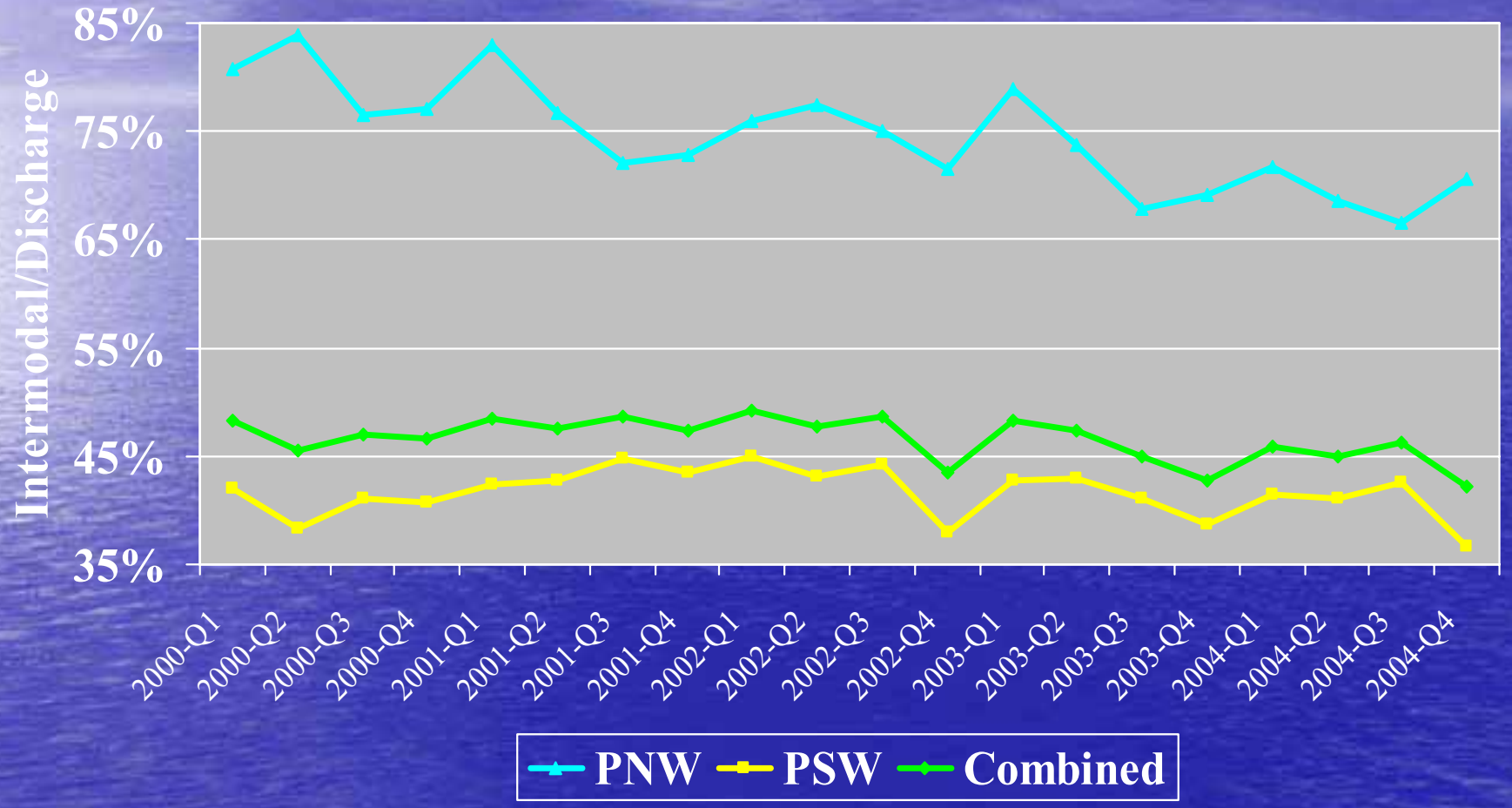
Categorization of trade flows

- Discretionary Traffic is helpful to understanding demand elasticity
  - Identified and categorized shipments to U.S. destinations into "local," "short-run discretionary" and "long-run discretionary"
  - 77% of SPB container traffic is discretionary in this context

Inland point intermodal movements

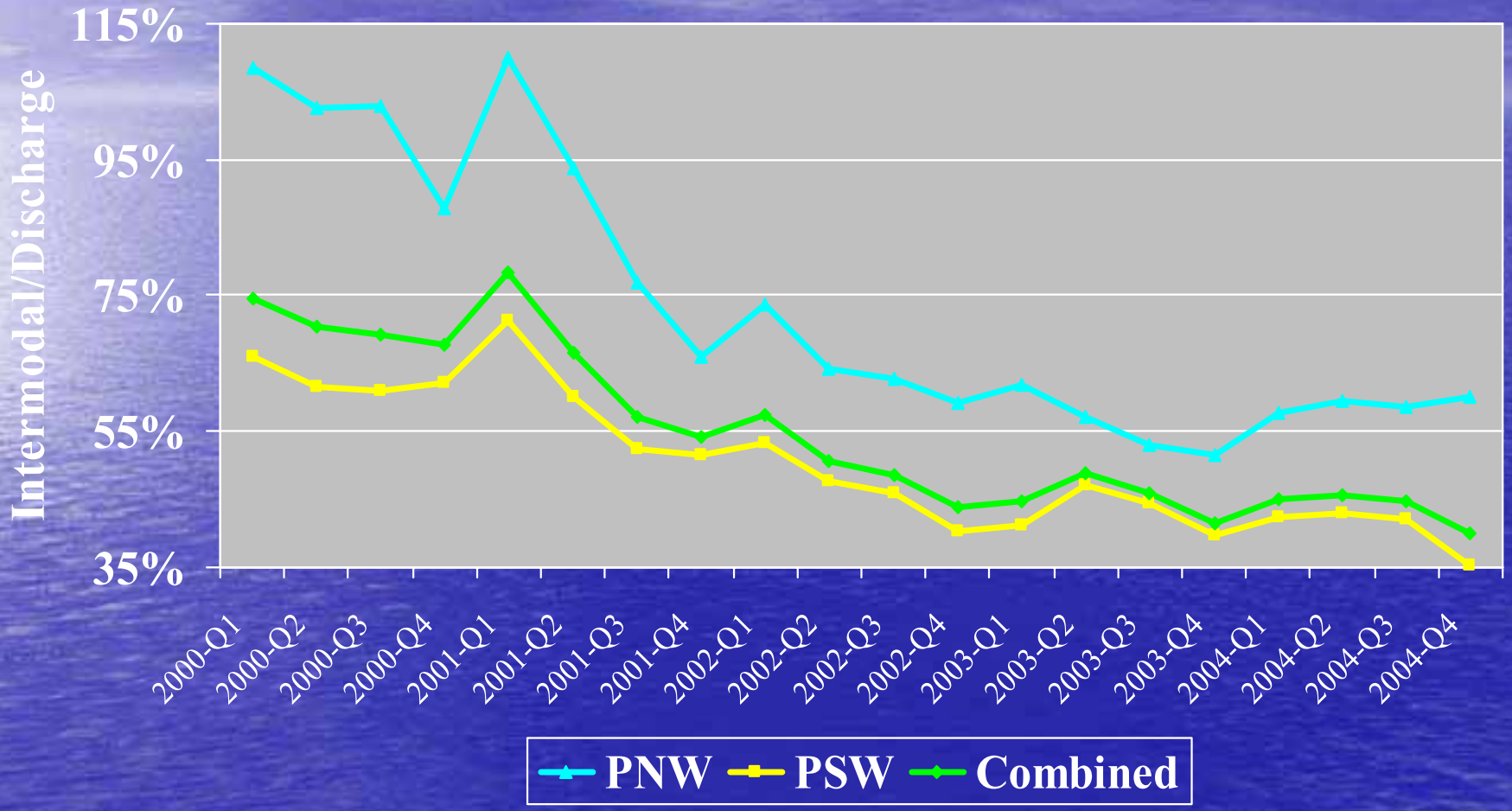
- In 1996, (pre-transloading), 48% of container flows through the SPB Ports were to/from the "intermodal" regions: the Upper Midwest, the East, and the South
- Inland-point rail intermodal movement of marine containers is now down to about 37% …

Eastbound intermodal % from US West Coast – 40’ boxes



Source: PMA Web site (Discharge) and IANA (Intermodal)

Eastbound intermodal % from US West Coast – 45' boxes



Source: PMA Web site (Discharge) and IANA (Intermodal)

West Coast discretionary traffic

- Local traffic: estimated traffic to PNW + CA/NV + AZ/NM based on purchasing power of those states
- Discretionary *in the long run:* 100% minus local traffic
- Discretionary *in the short-run*: marine boxes moving via inland-point rail intermodal

West Coast discretionary traffic

- Discretionary in the *short-run*: 45% (37% at SPB)
- Discretionary in the *long-run*: 76% (77% at SPB)
- Local traffic: 24% (23% at SPB)
- The long-run discretionary traffic includes the cargo that undergoes re-mixing, value-added transformation and transloading for re-shipment to other regions as "domestic" freight

Transportation costs

- Cost per cubic foot is what matters to an importer
- A 53-foot domestic container has 60% more useable space than a standard 40-foot marine container
- A 53-foot truck has 70% more useable space
- Rail and truck rates are sub-linear in box size

Domestic vs. marine containers

Marine stack train

Domestic stack train

Transportation costs

- A database of total transportation costs from 10 ports of entry to 21 US destination regions was developed
  - Direct truck movement of marine box
  - Direct rail movement of marine box
  - Trans-load to domestic 53-foot container, then rail
  - Trans-load to truck
- Trans-load rail is $0.02 less - $0.05 more per cubic foot than direct rail from WC ports, and $0.07 - $0.15 more from EC ports
- Trans-load truck is $0.40 - $0.60 more from WC ports, $0.05 - $0.15 more from EC ports

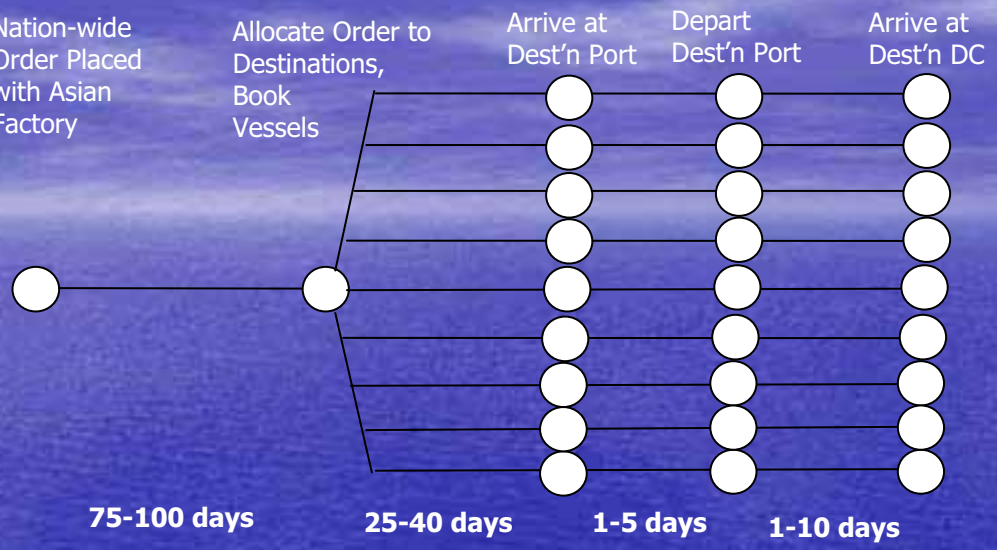
Inventory costs

- Two types of inventory costs are influenced by choice of supply channel:
  - Pipeline stocks
    - Proportional to transit time and value of goods
  - Safety stocks at destinations
    - Proportional to value of goods
    - Square root function of transit time, variability in transit time and sales forecast error over lead time
    - Square root function of volume to other destinations that is consolidated

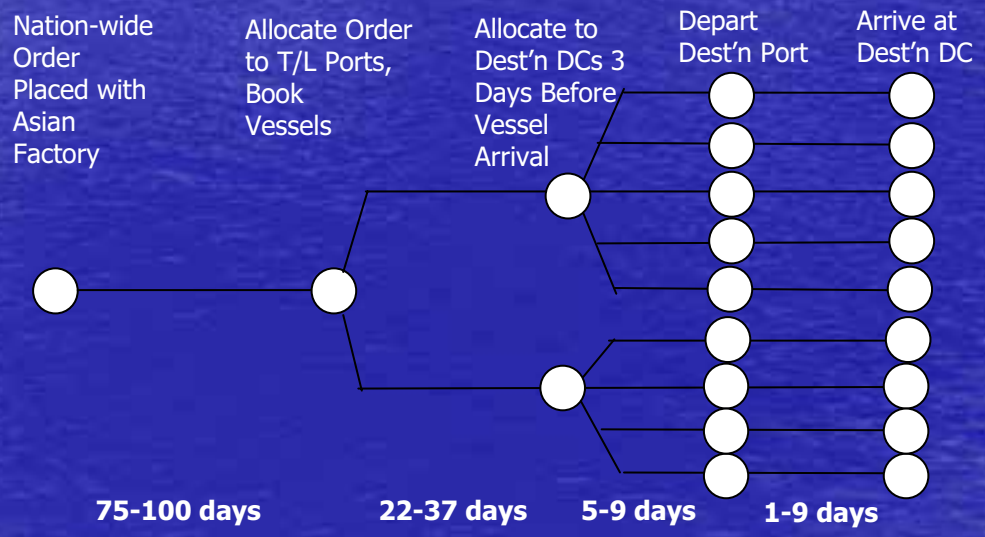
$$(k)\left[L_{AO}(1.25)^2 (MAPE)^2 D^2 + \left(\sum_m \sqrt{\sum_n \left(\frac{D_{m,n} L_{AW}(m)}{D_n} \right) \left(\frac{D_n}{D} \right)} (1.25)^2 (MAPE)^2 D^2 \right)^2 + \left(\sum_n \left(\frac{\sum_m D_{m,n} \sqrt{L_{NA}(m,n) + R}}{D_n} \right) \sqrt{\frac{D_n}{D}} (1.25)(MAPE) D \right)^2 + \left(\sum_{m,n} D_{m,n} \sqrt{\frac{\sum_m D_{m,n}}{\sum_n D_{m,n}} \sigma^2_{L_{AW}}(m) + \sigma^2_{L_{NA}}(m,n)} \right)^2 \right]^{1/2}$$

Impact of consolidation

Direct shipping:



Trans-loading:



Impact of consolidation

- Choosing inland U.S. destination from Asia is done 4 to 7 weeks ahead
- But choosing inland U.S. destination just prior to arrival at the U.S. port of entry is done 1 to 2 weeks ahead
- By means of consolidation (and trans-loading), sales forecast errors and transit time risks for multiple destinations may be pooled over 3 to 5 more weeks

Impact of trans-loading

- For the case of weekly shipping from Asia and 6% average error in nationwide one-week-ahead sales forecasts, trans-loading affords large, nation-wide retailers an 18-20% reduction in their total pipeline plus safety stock inventory (compared to direct shipping from Asia)
- No inventory reduction afforded for small or regional retailers

Trans-loading vs. direct shipping

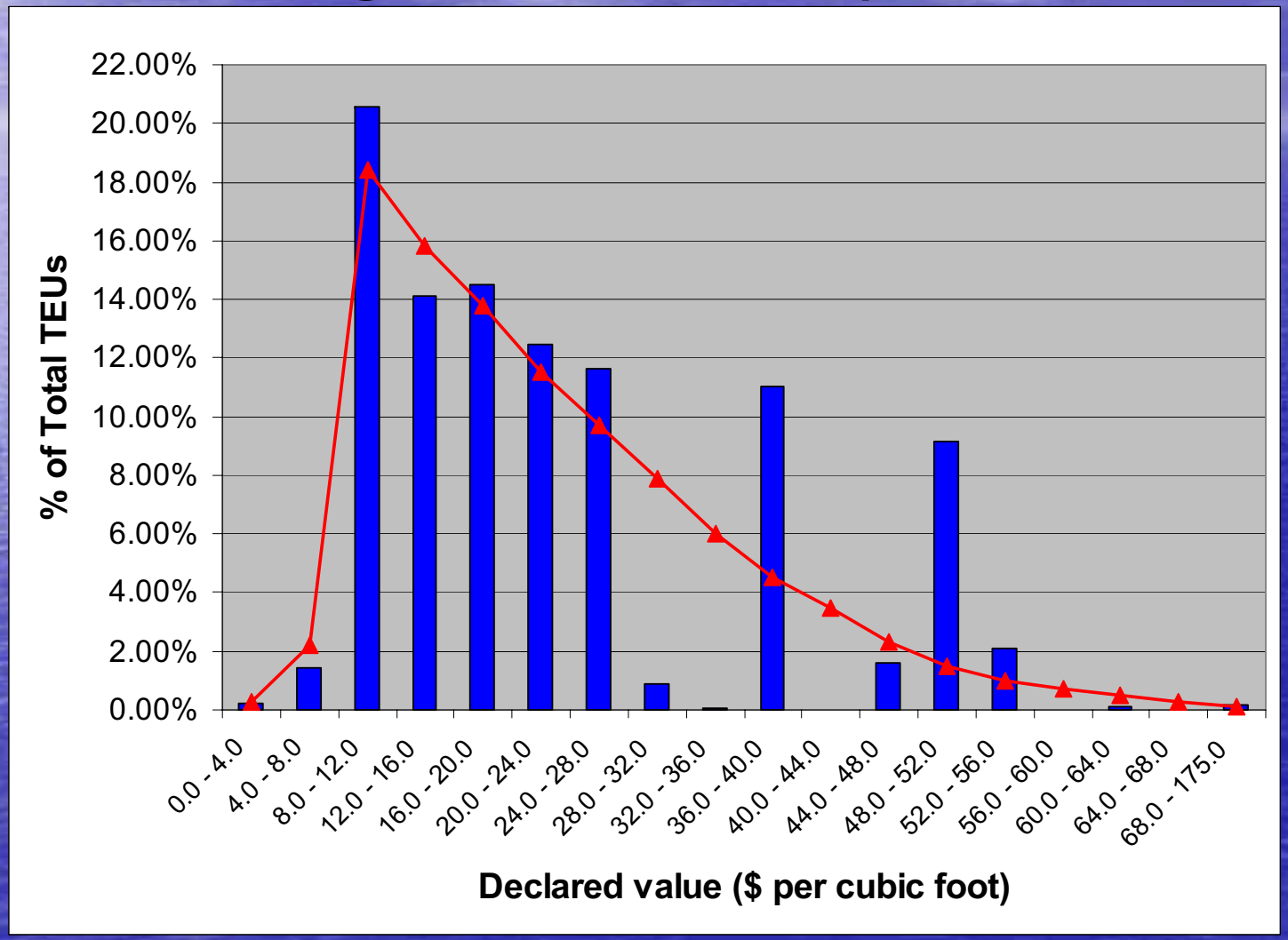
- Trade-off between inventory costs and transportation costs for large, nation-wide retailers (N/A for small or regional importers)
- For importers of low-value goods, direct shipping is cheapest
- For importers of moderate-value goods, trans-loading at multiple ports is cheapest
- For importers of high-value goods, trans-loading using a single port is cheapest

2003 Distribution of imports by commodity through U.S. West Coast Ports

Commodity	TEUs (1000s)	$ per Cu Ft
Furniture & Bedding	1,014	8.27
Electronics & Elect Eqpt	749	37.46
Toys, Games & Sports Eqpt	663	16.56
Machinery	661	50.23
Vehicles & Parts	480	20.19
Plastic goods	353	13.18
Apparel - not knitted	329	27.93
Footwear	318	24.37
Misc manufactured goods	274	23.42
Steel goods	265	14.13
Leather goods	199	18.05
Rubber goods	198	14.63
Apparel – knitted	149	53.81
Ceramic goods	109	8.38
All other	1,460	

Source: PIERS, WTA and PMA data

Distribution of declared values of Asian imports through West Coast ports



Largest importers of containerized Asian goods

Importer	Assumed avg. value per cu ft	PIERS 2004 Volume (TEUs)
Wal-Mart	$15	576,000
Home Depot	$ 9	301.200
Target	$20	202,700
Sears/K-Mart	$20	186,000
Ikea	$ 9	100,000
Lowe's	$ 9	100,000
Costco	$20	73,040
Ashley Furniture	$ 9	70,180

Source: PIERS Data published in Journal of Commerce

Part Two

Elasticity Model

The long-run elasticity model

- Model scope and structure
  - Importers
    - Considers top 83 actual Asian importers
      - These are the only ones eligible for trans-loading
    - Adds 19 "proxy miscellaneous" importer categories
      - To include all potential declared values from $2 to $70
  - USA divided into 21 destination regions
    - Served by 10 potential ports of entry
  - Mathematical basis – no stakeholder conversations

The long-run elasticity model (cont.)

- Model development
  - Volume for each importer distributed among all regions proportional to purchasing power
  - Objective function is to minimize total transportation and inventory costs for each importer
  - One homogeneous strategy assigned for all goods of each importer
    - No product differentiation

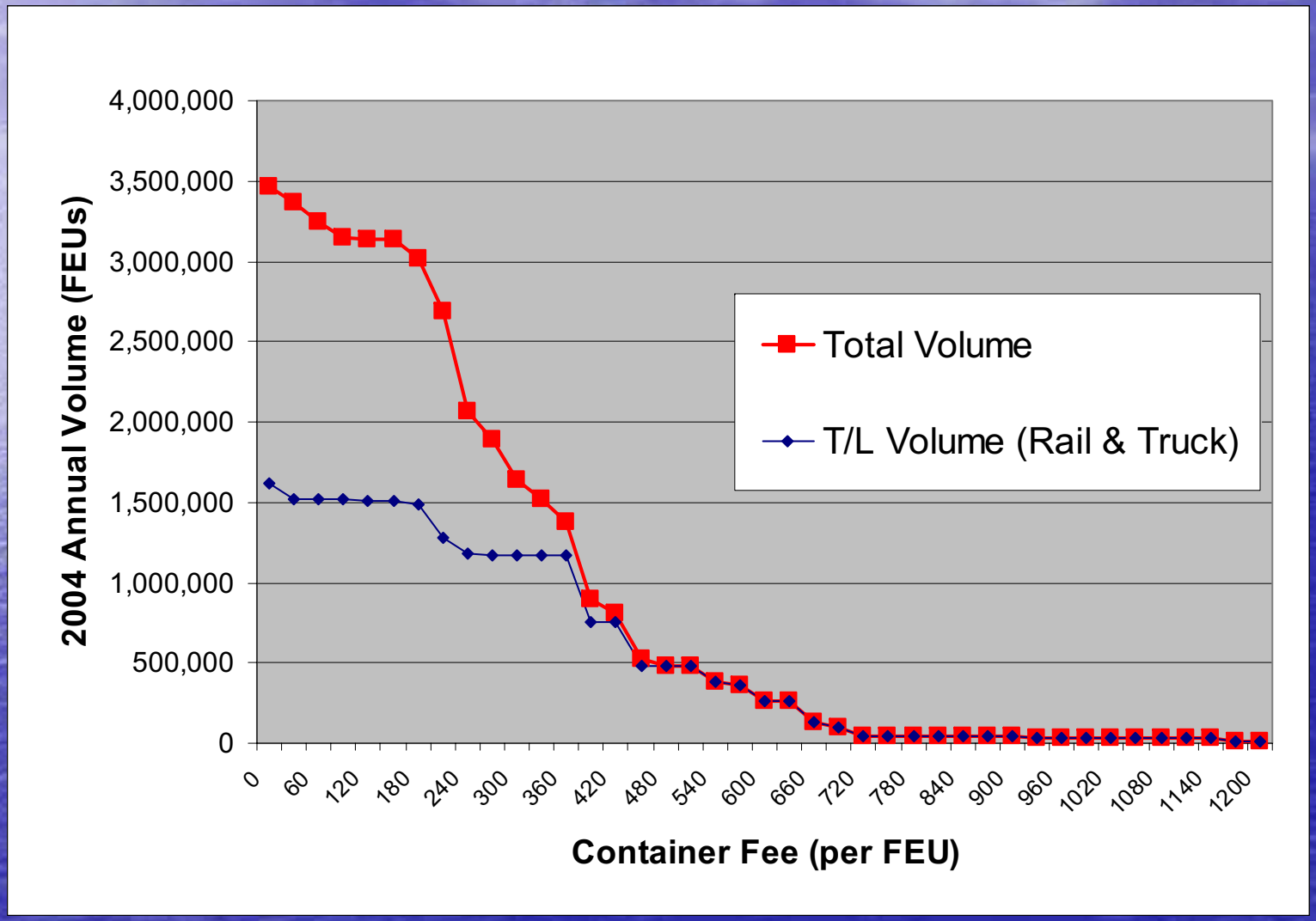
The long-run model (cont.)

- Total import volume and total trans-load import volume through the SPB ports are tabulated by model
- Model may be used for "what-if" analysis of new user fees, reduced transit times from new infrastructure investments, changes in rates, etc.
  - Fee value may be varied to construct elasticity curves

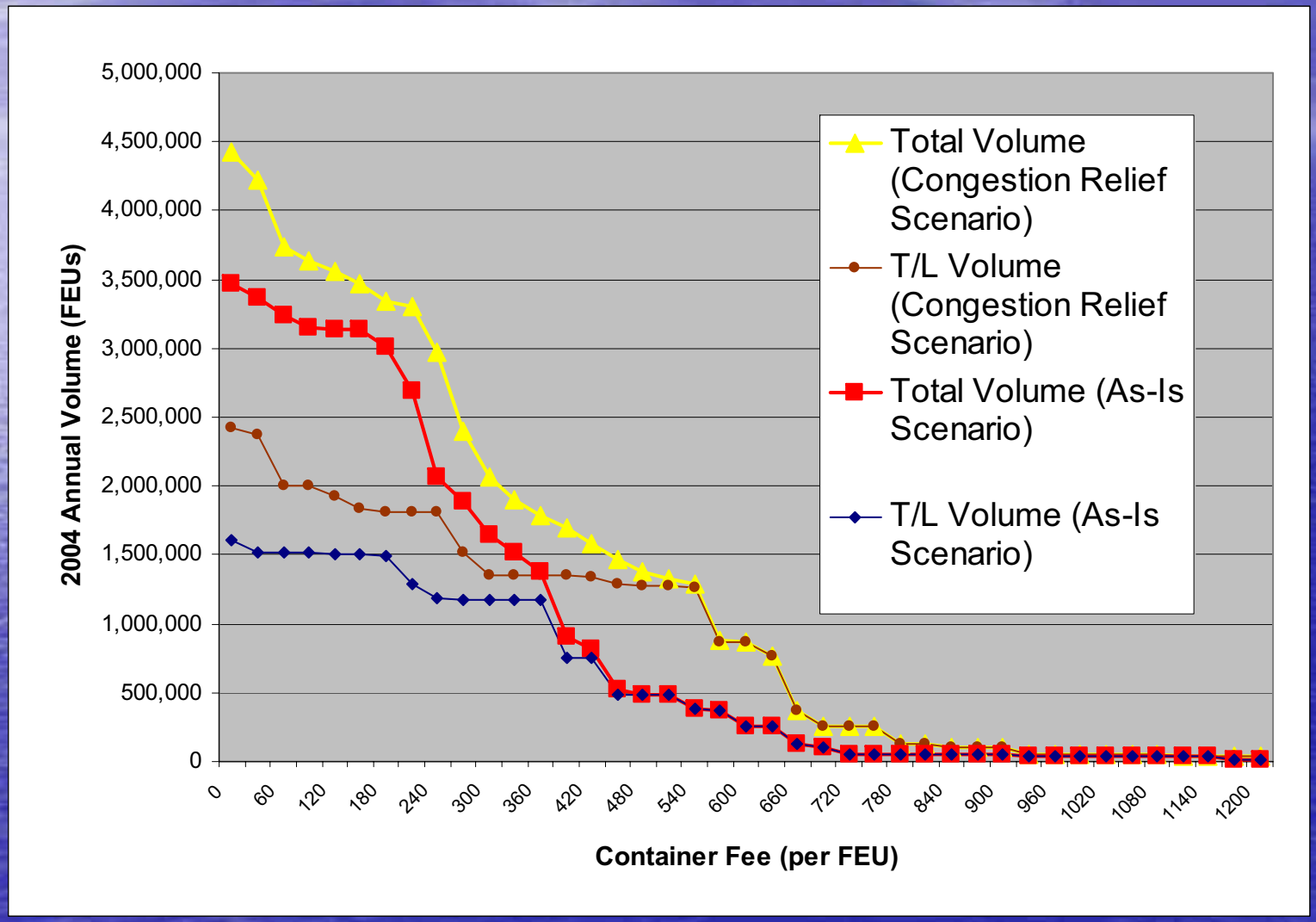
Scenarios analyzed

- As-is scenario
  - Container fee on the dock ranging from $0 up
- Congestion relief scenario
  - Container fee on the dock ranging from $0 up
  - Reduction in transit time from SPB ports to T/L warehouses (mean down by 1 day, s.d. down by 0.4 days)
  - Reduction in variability of rail transit time from LA Basin (s.d. down by 0.1 days)

Results – as-is scenario



Results – congestion relief scenario



Limitations of the long-run model

- Transit times are exogenous to the model
  - The impact of changes in congestion levels at ports and in landside channels is not captured
- Available warehouse capacity not considered
- Inertia from lane contracts not considered
- Economics of using port terminals as virtual warehouses is not considered
- Equipment re-positioning surcharges are not considered
- Diversification of congestion risk not considered

Interpretation of the model

- The elasticity curves reveal the points at which importers would have an economic incentive to reduce their routing of imports via the SPB ports
- In the short-run, SPB port volumes will be more inelastic than predictions of the model because of resulting congestion at other ports, capacities, contract commitments, etc.
- But large investments in access infrastructure should be confirmed to be sound investments by long-run elasticity calculations

Discussion of results

- If no congestion relief, even a small container fee would, in the long run, drive some traffic away from the SPB ports
  - The model predicts a $60 per FEU fee (such as proposed in the Lowenthal Bill) would cut total SPB import volume by 6.3% and cut trans-loaded import volume by 5.9%, if no reduction in transit times

Discussion of results (cont.)

- The congestion relief scenario would significantly alter the mix of traffic through the SPB Ports
  - A fee in the range of $190-$200 per FEU results in 12.5% more trans-loading volume, 4% less total volume
- There would be a significant increase in economic activity in Southern California

Funding potential of container fees

- How to fund $20 billion in infrastructure investment?
  - $16 billion for dedicated truck lanes from ports to warehouse districts
  - $4 billion for rail and terminal capacity improvements
  - NPV assumptions are extremely conservative:
    - Import growth of 6% per year
    - Tax-exempt bonds issued at 6% for 30 years
    - No funding available other than bonds
- Container fee of $192 per import FEU is sufficient to generate the bond repayment required for the assumed congestion relief

Funding potential of fees (cont.)

- What if the underlying assumptions on funding $20 billion in infrastructure investment change?
  - Assumptions could be very aggressive:
    - Import growth of 10% per year
    - Tax-exempt bonds issued at 4.5% for 30 years
    - Bonds only fund 50% of investment cost
- Then a container fee of only $47 per import FEU would be sufficient to generate the bond repayment required for the assumed congestion relief

Point of fee collection

- Container fees work best if applied on the dock to all inbound loaded containers
  - Avoid modal diversion
  - Maximize revenue collection
- No fee for outbound containers
  - Exports are very low value
  - Balance inbound/outbound containers to mitigate RR repositioning and switching

Conclusions

- SPB port volumes are much more elastic with respect to congestion than with respect to modest container fees
  - But they are nonetheless elastic w.r.t. fees
- Fees assessed but not used for congestion relief cause loss of volume in the long run. A fee of $60 per FEU would result in about a 6% drop in both total and trans-loaded imports if transit times are not reduced.

Conclusions (cont.)

- With congestion relief, SPB imports are inelastic up to about $200. A fee of $190 used to fund an effective program of congestion relief seems a wise investment. Total port volume might decrease marginally, but trans-loaded volume would increase more significantly.
- Fees above $200 per FEU are dangerous, even with congestion relief.

Further research

- Engage with more importers
  - Better data, better comprehension of their strategies
- Develop short-run elasticity model
  - Add congestion modeling and other factors
- Automate model calculations

Thank you for your attention